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| **Course Name**  *Penn Cambria Curriculum* | **Chemistry I** |
| **Length of Course** | 1 credit (1 semester in block schedule) |
| **Grade Level** | 10-11 |
| **Prerequisites** | None |
| **Course Description** | The study of chemistry is an essential subject in secondary education and is related to many other fields. An understanding of chemistry will allow students to make knowledgeable decisions about political, social, and environmental issues. Using a variety of techniques, students will study scientific methods, matter, energy, atomic theory, periodic law, bonding, nomenclature, chemical reactions, stoichiometry and gas laws. Emphasis is placed on student participation in the laboratory for discovery, application, and reinforcement. Although chemical mathematics is not emphasized, algebra skills are required. |
| **Units of Study** | Introduction to Chemistry Scientific Measurement Atomic Theory Periodic Table and Periodicity  Chemical Bonding  Chemical Formulas and Nomenclature Chemical Quantities Chemical Reactions and Equations Gases Solutions |
| **Materials** | Text: Chemistry: Concepts and Applications; Glencoe/McGraw-Hill; ©2005  Supplemental Materials: Lab supplies and equipment |

\*\* This course has been aligned to prepare students for the Keystone Chemistry Assessment.

Note: There is an honors level course offering for Chemistry 1.  
  
*At Penn Cambria High School, all core subject courses are aligned to the Pennsylvania Academic Standards and focus on ensuring students have a solid understanding of core concepts. In addition, all courses encourage critical thinking and an in-depth analysis of subject matter in addition to building a strong foundation.*

*The primary goal of the honors level curriculum alternative for these core courses is to provide students with a more in-depth study of the concepts by deepening the academic study and incorporating more academic reading. Students in the honors level of a core course will be expected to engage in analysis, evaluation and synthesis level activities with more frequency and for a longer duration than that found in the non-honors level course.*

**Unit 1:** Introduction to Chemistry

**Estimated Time:** 1.5-2.5 weeks

**Standard Alignment:**

3.1.12. D – Analyze scale as a way of relating concepts and ideas to one another by some measure.

3.4.12. A – Apply concepts about the structure and properties of matter.

3.4.12. B – Apply and analyze energy sources and conversions and their relationship to heat and temperature.

**Curricular Objectives:**

**Students will:**

* 1. Classify matter as an element, compound, or mixture.
  2. Classify physical or chemical changes within a system in terms of matter and/or energy.
  3. Observe chemical reactions, stating the evidence to the change.
  4. Differentiate between homogeneous and heterogeneous mixtures (e.g. how such mixtures can be separated).
  5. State the chemical symbol, and chemical/physical properties of 40 common elements.

**Assessments/ Measurement of Objectives:**

* Classification activities
* Lab observations/ reports
* Objective quizzes / test based on objectives
* Prediction, and data collection / analysis assessments

**Suggested Methods of Instruction / Learning Activities:**

* Guided practice (in/out of class)
* Classifying matter activities
* Classifying changes activities
* Chemical symbols reviews
* Physical/chemical classification activities
* Properties of elements lessons
* Laboratory Experiments/Reports
  + Evidence of chemical changes
  + Paper chromatography

**Unit 2: Scientific Measurement**

**Estimated Time:** 1.5 weeks (1 week instruction + ongoing application)

**Standard Alignment:**

3.7.12. B – Evaluate appropriate instruments and apparatus to accurately measure materials and processes.

**Curricular Objectives:**

**Students will:**

* 1. Classify observations as qualitative and/or quantitative.
  2. Utilize significant figures to communicate the uncertainty in a quantitative observation.
  3. Utilize the metric system of measurement.
  4. Convert between units within the metric system.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Qualitative/quantitative measurements activities
* Accuracy, precision and percent error activities
* Prefixes/conversions in the metric system activities / lessons
* Laboratory Experiments/Reports
  + Mass/volume/length measurements and conversions in the metric system.

**Unit 3: Atomic Theory**

**Estimated Time:** 2.5-3.5 weeks

**Standard Alignment:**

3.1.12. E – Evaluate change in nature, physical systems and man made systems.

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

1. Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).
2. Determine the number of subatomic particles in an atom of a given element.
3. Define an isotope and write their representations.
4. Differentiate between the mass number of an isotope and the average atomic mass of an element.
5. Relate the physical properties of matter to its atomic or molecular structure.
6. Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.
7. Predict the ground state electronic configuration and/or orbital diagram for a given atom or ion.
8. Explain the relationship between the electron configuration and the atomic structure of a given atom or ion (e.g. energy levels and/or orbitals with electrons, distribution of electrons in orbitals, shapes of orbitals).
9. Compare and analyze types of waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, x-rays, microwaves) as it relates to their properties, energy levels and motion.
10. Identify metallic ions in flame tests.
11. Observe and identify atomic spectra using spectroscope.
12. Relate the existence of quantized energy levels to atomic emission spectra.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Timeline of atomic theory/structure lesson and activity
* Properties of subatomic particles classroom activities
* Subatomic particles in a given element exercise
* Isotope representations class activity
* Atomic mass calculations lesson and practice
* Laboratory Experiments/Reports
  + Isotopic pennies
  + Law of conservation of matter
  + Qualitative identification of metals by flame tests
  + Observation/identification of atomic spectra

**Unit 4: Periodic Table and Periodicity**

**Estimated Time:** 1.5-2.5 weeks

**Standard Alignment:**

3.1.12. C – Assess and apply patterns in science and technology.

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

* 1. Explain the origin of the periodic table, including the contributions of Mendeleev, Ramsey and Moseley.
  2. Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table.
  3. Predict characteristics of an atom based on its location on the periodic table (e.g. number of valence electrons, potential types of bonds, reactivity).
  4. Compare and/or predict the properties (e.g. electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations of the periodic table and known trends.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Timeline of periodic table development
* Electron configurations and Lewis dot notations lesson and activities
* Physical/chemical property variation and prediction lesson and activities
* Laboratory Experiments/Reports
  + Periodic law (predicting density and solubility of group II/IV elements).

**Unit 5: Chemical Bonding**

**Estimated Time:** 2.0-2.5 weeks

**Standard Alignment:**

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

* + 1. Distinguish between cations and anions.
    2. Recognize patterns of cation/anion nomenclature.
    3. Describe how ions form.
    4. Predict the characteristics of an ion based on its location on the periodic table.
    5. Explain how atoms combine to form compounds through ionic and covalent bonding.
    6. Classify a bond as being polar covalent, non-polar covalent, or ionic.
    7. Use illustrations to predict the polarity of a molecule.
    8. Recognize and describe different types of models that can be sued to illustrate the bonds that hold atoms together in a compound (e.g. computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).
    9. Relate the physical properties of matter to its molecular structure.
    10. Utilize Lewis dot structures to predict the structure and bonding in simple compounds.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Ionic/covalent bonding reactions
* Drawing Lewis dot structures
* Laboratory Experiments/Reports
  + Building molecular models
  + Ionic/covalent properties

**Unit 6: Chemical Formulas and Nomenclature**

**Estimated Time:** 1.5-2.5 weeks

**Standard Alignment:**

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

1. Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas.
   * + Binary covalent
     + Binary ionic
     + Ionic compounds containing polyatomic ions

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Writing chemical formulas activity
* Chemical nomenclature lesson and classroom activities
* Laboratory Experiments/Reports
  + Qualitative analysis of halide ions.

**Unit 7: Chemical Quantities**

**Estimated Time:** 1.5-2.5 weeks

**Standard Alignment:**

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

1. Apply the mole concept to representative particles (e.g. counting, determining mass of atoms, ions, molecules, and/or formula units).
2. Relate the percent composition and mass of each element present in a compound.
3. Determine the empirical and molecular formulas of compounds.
4. Apply the law of definite proportions to the classification of elements and compounds as pure substances.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Formula mass calculations
* Percentage composition calculations
* Laboratory Experiments/Reports
  + Percentage composition of foods (hotdogs and popcorn).

**Unit 8: Chemical Reactions and Equations**

**Estimated Time:** 1-1.5 weeks

**Standard Alignment:**

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

1. Balance chemical equations by applying the Law of Conservation of Matter.
2. Include state symbols in an equation which describe the reactants and products.
3. Classify reactions as synthesis, decomposition, single replacement, double replacement, or combustion.
4. Describe factors that influence the frequency of collisions during chemical reactions that might affect reaction rates (e.g., surface area, concentration, catalyst, temperature, agitation).
5. Predict products of simple chemical reactions (e.g. synthesis, decomposition, single replacement, double replacement, combustions).

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives
* Writing word and formula equations
* Identify reaction types

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Writing word and formula equations
* Identify reaction types
* Balancing
* Product prediction activities
* Laboratory Experiments/Reports
  + Reaction types/balanced chemical equations.

**Unit 9: Gases**

**Estimated Time:** 1.5-2.5 weeks

**Standard Alignment:**

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

1. Describe the movement, volume, attractive/repulsive forces, and collision elasticity of gas molecules as defined by the kinetic molecular theory.
2. Explain pressure and temperature at molecular level.
3. Define standard conditions of pressure and temperature.
4. Convert between common units of temperature/pressure.
5. Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle’s law, Charles’s law, Dalton’s law of partial pressures, the combined gas law, and the ideal gas law).
6. Predict the amounts of reactants and products involved in a chemical reaction using molar volume of a gas at STP.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Boyle’s law calculations
* Charles’ law calculations
* Gay-Lussac’s calculations
* Combined gas law calculations
* Graham’s law calculations
* Laboratory Experiments/Reports
  + Boyle’s Law (PV=k)

**Unit 10: Solutions**

**Estimated Time:** 1.0-1.5 weeks

**Standard Alignment:**

3.4.12. A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

* 1. Compare properties of solutions containing ionic or molecular solutes (e.g. dissolving, dissociating).
  2. Describe how factors can affect solubility (e.g. temperature, concentration, surface area).
  3. Describe various ways that concentration can be expressed and calculated (e.g. molarity, percent by mass, percent by volume).
  4. Describe how chemical bonding can affect whether a substance dissolves in a given liquid.

**Assessments/ Measurement of Objectives:**

* Lab observations/ reports
* Objective quizzes / test based on objectives
* Classroom activities / projects based on objectives

**Suggested Methods of Instruction / Learning Activities:**

* Guided Practice (in/out of class)
* Molarity calculations; percent concentrate calculations
* Predict the solubility of ionic/covalent compounds
* Laboratory Experiments / Reports
  + Distillation